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Performance of French marigold (*T. Patula*) varieties for growth, yield and flower characters

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Abstract

A field experiment was conducted to find out performance of different varieties of (*T. Patula*) for growth, yield and flower characters. The materials utilized for the study consisted of French marigold (*Tagetes patula*) varieties namely, Dainty Marieta, Boy-O-Boy, Gulzafri Orange, Gulzafri Yellow, Bolero Red, Queen Sophia, Pusa Arpita, Orange Winner, Red Brocade, F/R-8 and F/R-2. The performance of different varieties for vegetative, flowering quality and yield characters showed significant differences. Plant height was recorded maximum in Pusa Arpita. Among the eleven varieties F/R-2 were recorded maximum for plant spread, primary branches, stem girth, leaf length, number of flower per plant, flower yield per plant, flower diameter, fresh weight per flower, duration of flower harvest index and flower longevity on the plant. Whereas, Red Brocade was observed maximum in number of flower thus, these varieties can be recommended for commercial loose flower production.

Keywords: French marigold (*Tagetes patula*), varieties, performance, vegetative, flowering parameters

Introduction

Floriculture is expanding very fast as an industry world over, lot of importance is being given to this sector due to its multiple uses, satisfying the aesthetic needs of the people, creating more employment, ensuring higher rate of returns to rural people and facilitating earning more foreign exchange. More specifically, they are being used as raw materials in the manufacture of essence, perfumes, medicines and confectioneries for direct consumption by the society. In India, large amount of total floriculture area is under loose or traditional flower production. India's share in the world floriculture trade is around 0.6% and approximately 328.00 thousand hectares area was under cultivation in floriculture with production of 1,695 thousand tonnes loose flowers during 2016-17 (3rd Estimates APEDA). Enormous genetic diversity, varied agro climatic conditions and versatile human resources offer India a unique scope for diversification into new avenues which have not been explored to a greater extent.

Marigold (*Tagetes* sp.) which belongs to the family asteraceae and native of South and Central America, especially Mexico is one of the most popular loose flower crops grown in India due to its ease in cultivation, low nutrient requirement, easily availability of planting material and adaptation under wide range of growing conditions. Major marigold growing states are Karnataka, Gujarat, Maharashtra, Haryana, Punjab, Andhra Pradesh, Uttar Pradesh, Chhattisgarh, Odisha, Jammu & Kashmir, West Bengal, Tamil Nadu, etc. In India, marigolds occupy an area of 66.13 Thousand Ha. With production of 603.18 Thousand MT loose flower (NHB database, 2015-16). *Tagetes patula* (French marigold) are commonly grown for loose flower production which are either single, semi double or double. The main emphasis in marigold improvement has been on the development of varieties having attractive colour, large size, high yield, harvest index with long duration of flowering etc. The performance of any crop or variety largely depends on genotypic and environmental interaction. As a result, cultivars, which perform well in one region, may not perform same in other regions of varying climatic conditions. Hence, it becomes very much necessary to study the morphological variation, development of high yielding varieties with better quality and to find out suitable variety for a particular region. Thus, the present investigation was conducted to study the relative performance of eleven cultivars of *T. patula* for their vegetative growth, flower quality and yield parameters.

Materials and Methods

The materials utilized for the present study consisted of French marigold (*Tagetes patula*)

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namely as var. Dainty Marieta, Boy-O-Boy, Gulzafri Orange, Gulzafri Yellow, Bolero Red, Queen Sohpiya, Pusa Arpita, Orange Winner, Red Brocade, F/R-8 and F/R-2. Seeds of genotypes were sown and transplanted at experimental unit of was carried in the Division of Floriculture and Landscaping, ICAR-Indian Agricultural Research Institute, New Delhi during 2014-18. Experiment was laid out in randomized block design with three replications and observations were recorded in monthly intervals. The spacing between rows and between plant and within a row was kept 45 cm. Basal dose of N: P: K: @ 12.8g and 8.0g, respectively per square meter was applied at the timing of planting. Foliar application of urea (0.1%) was given after one month of transplanting of seedlings. In rainy season crop, weekly irrigation was applied. Hoeing and weeding were done as and when required. Five plants were

selected for taking observations after discarding the border plants at both the ends. Data was recorded on various growth and yield related parameters. The mean values of five randomly selected plants from each variety in each replication were used for data analysis. The analysis of variance was carried out according to the standard procedure suggested by Panse and Sukhatme (1967) [4].

Results and Discussion

Analysis of variance for twenty characters indicated significant differences among the varieties for most of the growth and flowering related traits. This concluded the wide existence of variability for growth and flowering related traits which revealed that considerable improvement can be made.

Table 1: Performance of *T. patula* varieties for growth parameters

Sl. No	Genotypes	Plant height (cm)	Plant spread (cm)	No of primary branches	Pedicle length (cm)	Stem girth (cm)	Leaf length (cm)	Leaf width (cm)	Leaf biomass (g)	Internodal length (cm)	Total chl (mg/g)
1	F/R-2	55.14	63.55	14.62	8.45	1.38	14.96	9.39	126.28	1.95	2.21
2	Gulzafri Yellow	74.58	61.30	12.55	7.45	1.33	14.70	9.46	120.79	1.68	2.36
3	Queen Sophia	34.96	43.64	13.33	8.00	1.28	13.93	9.45	102.78	1.72	2.84
4	Boy-O-Boy	21.17	30.66	13.94	4.24	1.28	6.89	4.66	47.83	2.03	2.16
5	Gulzafri Orange	70.21	60.10	12.39	7.98	1.37	14.05	9.27	120.73	1.62	2.47
6	F/R-8	60.24	47.85	10.73	8.80	1.27	9.17	5.27	98.87	2.02	2.57
7	Bolero Red	28.17	24.77	9.82	4.80	1.26	8.63	6.50	76.77	2.19	3.28
8	Pusa Arpita	80.26	54.49	11.99	8.18	1.31	12.04	9.39	91.77	1.96	2.15
9	Red Brocade	44.88	48.78	11.09	7.30	1.21	11.96	7.43	89.05	1.96	2.09
10	Orange Winner	27.44	32.76	8.55	3.46	1.16	9.80	6.42	71.22	1.64	2.60
11	Dainty Marietta	27.06	29.88	8.10	4.87	1.17	7.30	4.81	42.17	1.82	2.96
	Mean	52.72	47.29	11.30	6.69	1.27	11.34	7.05	97.13	1.94	2.50
	C.D at 5%	4.27	2.84	0.75	0.33	0.03	0.58	0.30	3.06	0.09	0.15
	SE(m)	10.45	6.94	1.83	0.79	0.08	1.41	0.74	7.47	0.22	0.35
	C.V.	8.70	6.73	7.75	5.91	2.89	6.03	5.28	3.30	5.33	6.36

Table 2: Performance of *T. patula* varieties for flowering parameters

Sl. No	Genotypes	Flower diameter (cm)	Fresh weight flower(g)	Dry weight per flower(g)	Harvest index (%)	Days to first bud initiation (days)	Number of flower per plant	Flower yield per plant (g)	Duration of flowering (days)	Shelf life (days)
1	F/R-2	6.35	4.69	0.37	57.28	78.41	124.00	358.43	72.72	2.16
2	Gulzafri Yellow	5.46	3.28	0.36	52.73	80.77	111.71	277.84	67.54	2.13
3	Queen Sophia	6.01	4.20	0.38	51.33	66.28	71.82	288.80	65.94	1.99
4	Boy-O-Boy	3.97	3.23	0.27	46.33	54.50	59.45	232.98	62.88	1.99
5	Gulzafri Orange	5.69	3.18	0.36	54.89	75.45	90.37	268.98	68.37	1.75
6	F/R-8	4.02	3.33	0.28	46.39	57.88	73.03	219.83	60.61	1.30
7	Bolero Red	3.51	2.41	0.26	40.88	47.83	59.11	147.21	58.21	1.66
8	Pusa Arpita	4.34	3.28	0.31	45.93	74.62	89.04	198.98	59.48	2.21
9	Red Brocade	4.82	2.61	0.26	43.37	44.52	50.59	136.43	61.06	1.90
10	Orange Winner	4.32	2.61	0.22	37.83	51.12	28.33	134.25	54.72	1.70
11	Dainty Marietta	3.34	1.23	0.19	27.26	48.17	46.34	127.18	58.49	1.76
	Mean	4.46	3.18	0.30	48.37	70.81	71.03	210.41	62.36	1.96
	C.D. at 5%	0.28	0.08	0.02	3.14	2.50	7.69	16.16	3.29	0.09
	SE(m)	0.69	0.19	0.05	7.67	6.12	18.80	39.50	8.05	0.23
	C.V.	7.42	2.52	7.16	6.37	4.47	9.64	5.52	5.15	5.06

Among the varieties under study, Pusa Arpita had tallest height (80.26 cm) followed by Gulzafri Yellow (74.58 cm). Whereas, Boy-O-Boy showed minimum plant height (21.17 cm). Plant height is attributed to be an important varietal character that depends upon the genetic constitution. The variation in plant height among the various genotypes might be due to genotypic differences in phenotypic expression of plant height and variations in different genotype-environmental interaction effects on plant height. Similar variation in plant height due to genotypes was also

reported by Rao *et al.* (1982) [6], Singh and Singh (2006) [9]. FR-2 (63.55 cm) had maximum spread which is followed by Gulzafri Yellow (61.30 cm) and Bolero Red showed minimum spread (24.77 cm). The observations are in line with the finding of Singh *et al.* (2003) [10] and Choudhary *et al.* (2014) [2] in marigold, who also observed variation in plant spread in different genotypes of marigold due to the inherent character of marigold genotypes. Number of primary branches was found to have recorded maximum in F/R-2 (14.62 cm) followed by Boy-O-Boy (13.94 cm). Whereas, Dainty

Marietta showed minimum of number of primary branches (8.10 cm). The variation in number of primary branches might be due to the difference in their genetic composition and varied growth rate among the genotypes of marigold. Further, the individual genetic makeup of the genotypes may also have been influenced by the environmental conditions. Similar variations for number of branches were also observed by Ravikumar (2003) [7], Singh and Singh (2010) [8] in marigold and Munikrishnappa *et al.* (2013) [3] in China aster. F/R-8 (8.80 cm) was also revealed maximum pedicel length while Orange Winner (3.46 cm) recorded minimum pedicel length. Maximum stem girth was recorded in F/R-2 (1.38 cm) followed by Gulzafri Orange (1.37 cm) while, Orange Winner showed minimum stem girth (1.16 cm). The production of more number of leaves may be attributed to the production of more number of branches per plant. Similar variation in number of leaves among the genotypes was also observed previously in marigold by Singh and Misra (2008) and Zosiamlianana *et al.* (2012) [11] in China aster. Maximum leaf width was observed in Gulzafri Yellow (9.46 cm) followed by Queen Sophia (9.45 cm) and minimum was observed in Boy-O-Boy (4.66 cm). leaf biomass was recorded maximum in FR-2 (126.28 g) was followed by Gulzafri Yellow (120.79 g) and Gulzafri Orange (120.73 g). Whereas, minimum leaf biomass was observed in Dainty Marietta (42.17 g). Maximum intermodal length was recorded in Bolero Red (2.19 cm) followed by Boy-O-Boy (2.03 cm) while Gulzafri Orange (1.62 cm) recorded lowest. Bolero Red (3.28 mg/g) revealed significantly maximum total chlorophyll followed by Dainty Marietta (2.96 mg/g). Whereas, minimum was observed in Red brocade (2.09 mg/g). Number of flowers per plant was recorded maximum in F/R-2 (124.00) followed by Gulzafri Yellow (111.71). Flower yield per plant recorded highest in F/R-2 (358.43 g) followed by Queen Sophia (288.80 g) and minimum was recorded in Dainty Marietta (127.18 g). The variation in number of flower plant-1 might be due to hereditary traits of the genotypes. Number of flowers plant-1 may have increased with the increase in number of branches plant-1. Moreover, different photosynthesis efficacy of genotypes may have enhanced food accumulation resulting in better plant growth and subsequently higher number of flowers per plant. These results are in accordance with the findings obtained by Singh and Sangama (2000) in China aster. Similar results were reported by Narsude *et al.* (2010), Beniwal and Dahiya (2012), Singh *et al.* (2004) and Singh and Misra (2009) in marigold. F/R-2 (6.35 cm) male parents revealed maximum flower diameter followed by Queen Sophia (6.01 cm) while, minimum was observed in Dainty Marietta (3.34 cm). The variation in flower diameter might be due to genetic makeup of genotypes and more number of leaves which may have lead to more dry matter accumulation, resulting in the accumulation of maximum photosynthates that may have contributed to the production of bigger size flower. Similar results have been reported by Narsude *et al.* (2010) and Panwar *et al.* (2013) [5] in African marigold. The observations are in line with the findings of Mohanty *et al.* (2002) in marigold and Bhaskarar *et al.* (2016) in gaillardia. The different period required for first flower bud appearance in marigold genotypes might be due to varied growth rate and the genetic makeup of the genotypes. Maximum fresh weight per flower recorded in F/R-2 (4.69 g) followed by Queen Sophia (4.20 g). Whereas minimum fresh weight per flower was recorded in Dainty Marietta (1.23 g). The results are in accordance with the finding of Singh and Misra (2009), Rao

et al. (2005), Narsude *et al.* (2010) and Beniwal and Dahiya (2012) and Manik *et al.* (2016) in marigold. Dry weight per flower was recorded maximum in Queen Sophia (0.38 g) followed by Orange Winner (0.22 g). Highest harvest index was recorded in F/R-2 (57.28%) followed by Gulzafri Orange (54.89 %) while Dainty Marietta (27.26 %) recorded lowest harvest index. F/R-2 (72.72 days) was recorded maximum duration of flowering followed by Gulzafri Orange (68.37 days). Orange Winner had minimum flowering duration (54.72 days). The genetic control of the characters and modification in their expression due to environmental conditions might be the possible cause observed for variation in duration of flowering (Choudhary *et al.* 2014) [2]. Panwar *et al.* (2013) [5] reported in general a high range for duration of flowering in African marigold. Similar findings have been also reported by Raghuvanshi and Sharma (2011) in African marigold. Shelf life was found maximum in Pusa Arpita (2.21 days) followed by F/R-2 (2.16 days) whereas, minimum was observed in F/R-8 (1.30 days).

Conclusion

Significant variations were observed among marigold varieties. The performance of different varieties for vegetative, flowering quality and yield characters showed significant differences. Among the eleven varieties maximum plant height were recorded in Pusa Arpita. F/R-2 were recorded maximum for plant spread, primary branches, stem girth, leaf length, number of flower per plant, flower yield per plant, flower diameter, fresh weight per flower, duration of flower harvest index and flower longevity on the plant, thus these varieties can be recommended for commercial loose flower production while F/R-2. Red Brocade taken up for maximum number of flower production.

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